Claims

1. (currently amended) A method of anisotropically etching a substrate assembly, comprising:

forming a resist layer on a surface of the substrate assembly, the resist layer having a thickness;

defining patterns in the resist layer by removing portions of the resist layer; ~~and~~

exposing the resist layer and the surface of the substrate assembly to a first plasma etch and simultaneously etching a portion of the substrate exposed by the step of removing portions of the resist layer and increasing the thickness of the resist layer with the first plasma etch; and

exposing the resist layer and the surface of the substrate assembly to a second plasma etch and simultaneously etching a portion of the substrate exposed by the step of removing portions of the resist layer and decreasing the thickness of the resist layer with the second plasma etch.

2. (original) The method of claim 1, wherein the step of simultaneously etching a portion of the substrate assembly and increasing the thickness of the resist layer is performed by exposing the surface of the substrate assembly to a plasma generated in a gas mixture consisting essentially of a fluorinated, chlorinated, or hydrogenated hydrocarbon gas.

3. (currently amended) The method of claim 2, wherein the first plasma is generated in a gas mixture consists essentially of at least one of the gases CF4, ~~CHF3.~~ CHF3, CH2F2, CH3F, C2F6, C2HF5, C3F8, C4F8, C4F6, and C5F8.

4. (original) The method of claim 2, wherein the gas mixture consists essentially of CH2F2.

5. (original) The method of claim 1, wherein the thickness of the resist layer is less than about 600 nm.

6. (original) The method of claim 1, wherein the resist layer has a thickness d, and a high aspect ratio feature is etched into the substrate to a depth D such that D/d > 5.

7. (currently amended) The method of claim 1, wherein the thickness of the resist layer is a facet thickness and the first plasma etch increases the facet thickness.

8. (currently amended) The method of claim 1, wherein the thickness of the resist layer is a nominal thickness and the first plasma etch increases the nominal thickness.

9-11. (canceled)

12. (currently amended) A method for plasma etching an oxide layer formed on a silicon wafer, the oxide layer partially covered with a patterned layer of a resist, the method comprising:

exposing the oxide layer and the patterned layer of resist to a first gas consisting essentially of CH2F2;

generating a plasma within the first gas;

directing ions from the plasma onto exposed portions of the oxide layer; ~~and~~

adjusting the flow of the first gas so that the exposed portions of the oxide layer are etched such that the oxide layer is etched at a rate at least five times faster than the resist; and

etching the portion of the substrate assembly that is not covered by the resist with a plasma generated in a flow of a second halogenated hydrocarbon containing a second gas that etches the surface of the substrate and the resist layer.

13. (currently amended) The method of claim 12, wherein the patterned layer of resist has a nominal thickness and the gas flow of the first gas is adjusted so that the nominal thickness decreases at a rate that is at least ten times slower than the rate at which the oxide layer is etched.

14. (currently amended) A method of etching a substrate assembly, comprising:

forming a resist layer on a surface of the substrate assembly;

defining a feature on the surface of the substrate assembly by patterning the resist layer so that the resist layer is removed from at least a portion of the substrate;

etching the portion of the substrate that is not covered by the resist layer and depositing a material on the resist layer with a first plasma generated in a flow of a first halogenated hydrocarbon containing gas so that the etched feature has an aspect ratio of at least 5:1; and

etching the portion of the substrate assembly that is not covered by the resist with a second plasma generated in a flow of a second halogenated hydrocarbon containing gas that etches the surface of the substrate and the resist layer.

15. (original) The method of claim 14, wherein the etched feature has an aspect ratio of at least 10:1.

16. (original) The method of claim 14, wherein the patterned layer of resist has a facet thickness and the step of etching the substrate with the first plasma is resist-conserving with respect to the facet thickness.

17. (canceled)

18. (currently amended) The method of claim 14, wherein the portion of the surface exposed to the first plasma and the second plasma is etched so that the etched feature has an aspect ratio of at least 10:1.

19. (original) The method of claim 14, further comprising forming an oxide layer on the surface of the substrate assembly, forming the resist layer on the oxide layer, and patterning the resist to expose a portion of the oxide layer.

20-34. (canceled)

35. (original) A method of plasma etching a surface of a substrate assembly having patterns defined by a resist layer, comprising:

enclosing the substrate assembly in a silicon or silicon carbide enclosure;

selecting a surface of the substrate assembly to be etched;

selecting a gas or gas mixture;

adjusting a flow rate of the gas or gas mixture into the chamber so that the resist layer etches at a rate that is at least 10 times slower than the etch rate of the selected surface;

exposing the substrate assembly to a gas flow; and

generating a plasma in the gas flow with an applied magnetic field.

36. (original) A method of etching a substrate assembly, comprising:

selecting a gas or gas mixture;

providing a predetermined flow rate of the gas or gas mixture to an enclosure at a predetermined pressure;

maintaining the temperature of the enclosure at about 140 C;

patterning a surface of the substrate assembly with a resist;

situating the substrate assembly inside the enclosure;

heating or cooling the substrate assembly to achieve a substrate assembly temperature of about -10 C;

providing a silicon getter at a temperature of about 200 C within the enclosure;

producing a plasma in the gas or gas mixture in the enclosure with an applied radio-frequency excitation at a frequency of between 1 and 3 MHz;

exposing the substrate assembly to the plasma; and

etching the surface of the substrate assembly at a rate that is at least 10 time greater than a rate at which the resist etches.

37-40. (canceled)

41. (original) A method of manufacturing, comprising:

patterning a resist layer on a substrate assembly so that portions of the substrate assembly are exposed;

etching the exposed portions of the substrate assembly with a resist-conserving etch; and

etching the exposed portions of the substrate assembly with a resist-consuming etch.

42. (currently amended) A method of plasma etching a surface of a substrate assembly, comprising:

forming a layer of a resist on the surface of the substrate assembly, the resist layer having a nominal thickness t_N;

patterning the resist by removing selected portions of the resist to expose corresponding portions of the surface of the substrate assembly; ~~and~~

exposing the resist layer and the exposed portions of the surface of the substrate assembly to a resist-conserving etch; and

exposing the resist layer and the exposed portions of the surface of the substrate assembly to a resist-consuming etch.

43. (original) The method of claim 42, wherein the exposed portions of the substrate assembly are etched to a depth of at least $5t_N$.

44. (original) The method of claim 42, wherein the exposed portions of the substrate assembly are etched to a depth of at least $10t_N$.

45. (original) The method of claim 42, wherein the resist-conserving etch has a start-up loss and the nominal thickness t_N of the resist layer is less than twenty times the start-up loss.

46. (new) A method of anisotropically etching a substrate assembly, comprising:

forming a resist layer on a surface of the substrate assembly, the resist layer having a thickness;

defining patterns in the resist layer by removing portions of the resist layer; and

exposing the resist layer and the surface of the substrate assembly to a plasma generated in a gas mixture consisting essentially of a chlorinated hydrocarbon gas and simultaneously etching a portion of the substrate exposed by the step of removing portions of the resist layer and increasing the thickness of the resist layer with the plasma.